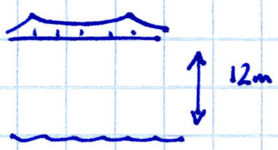
APPLYING KINEMATIC EQ^NS TO BODIES UNDER FREE-FALL CONDITIONS

#1



$\vec{v}_1 = 0\ m/s$
$\vec{a} = 9.8\ m/s^2$
$\Delta\vec{d} = 12\ m$

(+ down)

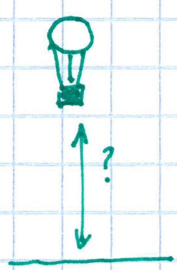
(a) $\Delta t = ?$

$\Delta\vec{d} = \vec{v}_1\Delta t + \frac{1}{2}\vec{a}\Delta t^2$
$12 = 4.9\Delta t^2$
$\Delta t = 1.56\ s$

(b) $\vec{v}_2 = ?$

$\vec{v}_2^{\,2} = \vec{v}_1^{\,2} + 2\vec{a}\Delta\vec{d}$
$= 2(9.8)(12)$
$\vec{v}_2 = \sqrt{235.2}$
$= 15.34\ m/s$

#2



$\vec{v}_1 = 0\ m/s$
$\vec{v}_2 = 73\ m/s$
$\vec{a} = 9.8\ m/s^2$

(+ down)

(a) $\Delta\vec{d} = ?$

$\vec{v}_2^{\,2} = \vec{v}_1^{\,2} + 2\vec{a}\Delta\vec{d}$
$73^2 = 19.6\Delta\vec{d}$
$\Delta\vec{d} = 271.9\ m$

(b) $\Delta t = ?$

$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$
$73 = 9.8\Delta t$
$\Delta t = 7.45\ s$

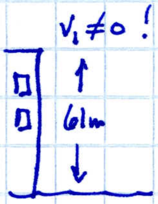
#3

$\vec{v}_1 = 0\ m/s$
$\vec{a} = 2.4\ m/s^2$
$\vec{v}_2 = 61\ m/s$
$\Delta\vec{d} = ?$

(+ →)

$\vec{v}_2^{\,2} = \vec{v}_1^{\,2} + 2\vec{a}\Delta\vec{d}$
$61^2 = 4.8\Delta\vec{d}$
$\Delta\vec{d} = 775\ m$

#4



$\vec{v}_1 = ?$
$\vec{a} = 9.8\ m/s^2$
$\Delta\vec{d} = 61\ m$
$\Delta t = 3.1\ s$

(+ down)

$\Delta\vec{d} = \vec{v}_1\Delta t + \frac{1}{2}\vec{a}\Delta t^2$
$61 = 3.1\vec{v} + 4.9(3.1)^2$
$13.91 = 3.1\vec{v}$
$\vec{v} = 4.49\ m/s$

#5

(a)

$\vec{v}_1 = 33\ m/s$
$\vec{a} = -9.8\ m/s^2$
$\vec{v}_2 = 0\ m/s$
$\Delta\vec{d} = ?$

(+ up)

$\vec{v}_2^{\,2} = \vec{v}_1^{\,2} + 2\vec{a}\Delta\vec{d}$
$0 = 33^2 + 2(-9.8)\Delta\vec{d}$
$\Delta\vec{d} = 55.6\ m$

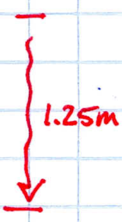
(b) *time to go up = time to go down*

$\vec{v}_1 = 33\ m/s$
$\vec{a} = -9.8\ m/s^2$
$\vec{v}_2 = 0\ m/s$
$\Delta t = ?$

$\vec{v}_2 = \vec{v}_1 + a\Delta t$
$0 = 33 - 9.8\Delta t$
$\Delta t = 3.37\ s$ (up)

$\therefore \Delta t = 6.74\ s$

#6



$v_1 = 0\,m/s$

$\vec{a} = 1.62\,m/s^2$

$\Delta\vec{d} = 1.25\,m$

$\Delta t = ?$

(+ ↓)

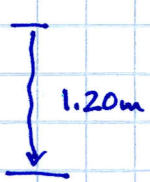
(a) $\Delta\vec{d} = \vec{v}_1\Delta t + \frac{1}{2}\vec{a}\Delta t^2$

$1.25 = \frac{1}{2}(1.62)\Delta t^2$

$\Delta t = 1.24\,s$

(b) It would take the hammer the same time since its acceleration would be the same.

#7



$V_1 = 0\,m/s$

$\vec{a} = 9.8\,m/s^2$

$\Delta\vec{d} = 1.20\,m$

~~Δt~~ $\vec{v}_2 = ?$

$\vec{v}_2^{\,2} = \vec{v}_1^{\,2} + 2\vec{a}\Delta\vec{d}$

$= 0 + 2(9.8)(1.20)$

$\vec{v}_2 = 4.85\,m/s$

#8

$\vec{v}_1 = ? = v$

$\vec{a} = -9.8\,m/s^2$

$\Delta t = 2.8\,s$

$\vec{v}_2 = ? = -v$

(↑ +)

$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$

$-v = v - 9.8\,(2.8)$

$-2v = -27.44$

$v = 13.72\,m/s$

<u>OR</u>

Consider only the motion up.
In this case $\Delta t = \frac{1}{2}(2.8)$
$= 1.4\,s$
and $v_2 = 0\,m/s$.

$\vec{v}_2 = \vec{v}_1 + \vec{a}\,\Delta t$

$0 = \vec{v}_1 - 9.8(1.4)$

$\vec{v}_1 = 13.72\,m/s$